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The Effect of a New Complex Sorbent of Mycotoxins in Pigs Diets on Their Growth Performance, Fattening and Meat Traits

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Abstract. Compliance with feed safety in livestock production requires pork producers to add mycotoxin-binding adsorbents to pig diets. Therefore, the purpose of the study was to evaluate the effect of two complex sorbents added to the diet of fattening pigs on their performance. The experiment included 90 pigs, which were kept in LLC "Tavriyski svyni" in the Kherson region. According to the principle of analogues, experimental animals were divided into three groups of 30 animals each: I – the control group of pigs consumed the basic diet "Grower", and "Finisher"; pigs of experimental group II consumed the basic diet "Grower", "Finisher" with the addition of 0.15% by weight of feed of a commercial analogue of mycotoxin adsorbent; animals of experimental group III received the basic diet "Grower", "Finisher" with the addition of 0.15% by weight of feed of the complex preparation "Hepasorbex". Animals that consumed feed containing adsorbents of mycotoxins had a higher live body weight, and average daily weight gain, reaching weights of 100 and 120 kg with lower feed conversion earlier compared to analogues of a control group. It was found that the introduction of "Gepasorbex" in the diet of store pigs of experimental group III at a pre-slaughter weight of 100 and 120 kg resulted in an increase in: slaughter yield, half-carcass length, muscle eye area, the weight of the hind third of the half-carcass and a decrease in the thickness of the fat compared to the control group. In terms of chemical composition, the meat of animals of experimental groups, both at slaughter in 100 kg and in 120 kg, met the requirements for pork of normal quality (NORMAL). At a live weight of 100 and 120 kg, pigs of experimental group III had significantly lower moisture content, higher protein, fat and ash content in meat. Due to the complex composition of "Gepasorbex" ingredients, the nutrients in the feed remained and were absorbed by the pig's body, which is confirmed by higher productivity indicators and significantly reduces the cost of the main expense item of pig farms in pig production technologies – "Feed". Therefore, this research is useful for specialists in pork production and processing in developing strategies for feeding pigs and obtaining quality raw materials for processing enterprises, which opens up ways to ensure food security in the country

Keywords: weight condition, feeding, feed sorbents, productivity, pig breeding

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Introduction

To eliminate the negative effects of mycotoxicosis on the body of animals (decrease in productivity, reproductive qualities, weakening of the immune system of animals, disruption of the gastrointestinal tract, kidneys, a hepatoprotective function of the liver, deterioration of the quality of meat raw materials, etc.) it is necessary to strictly control the content of mycotoxins in feed fed to pigs, which further ensures the preservation of not only animal health, but also the end consumers of livestock products [1].

Neutralisation of mycotoxins in feed using sorbents is a common and virtually the only method in systematic measures to combat mycotoxicosis in pigs [2; 3]. The use of intensively innovative technologies and pigs of high genetic potential to ensure productivity through the efficient use of feed resources, maximum preservation of animals and prevention of various diseases is a feature of the modern pig industry. This fact puts forward significant requirements for scientists and practitioners in providing high-quality and environmentally friendly feed, which is associated with their contamination with various toxins, heavy metals, pesticides, nitrates, etc. [4-6].

With sufficient and balanced feeding, the share of transformation of nutrients of the consumed feed into the substances of the product when growing pigs is 45-50%. An important aspect in solving this is the organisation of a full, balanced feeding of animals, that is, the use of diets that best meet the needs of pigs in terms of the content of basic nutrients and biologically active substances [7; 8]. Therefore, a number of studies are currently being conducted [9-11] to find the most effective sorbents that will get rid of mycotoxins and maximise the preservation of biologically active substances in the body of animals.

Despite the fact that the issue of mycotoxins has been known for more than 50 years [12-14], and the vast majority of pork producers have experienced their presence in feed, yet farms do not apply a full range of preventive measures against mycotoxicosis, which is the reason for low profitability of pork production [15-17].

Feed mycotoxins are products of fungal metabolism (*Aspergillus*, *Mucoraceae*, *Fusarium* etc.), which form stable compounds and disrupt various types of metabolism of the animal body, and, as a result, diseases of animals with a severe course that occur when feeding feed affected by toxic fungi: reduce the productivity of biological objects and the efficiency of using feed for the production of a unit of production; disrupt reproductive functions; weaken the immune system of animals and poultry; increase sensitivity to diseases; increase the cost of treatment and preventive measures, reducing the effectiveness of vaccines and medicines [18-21].

It should be noted that adsorbents of mycotoxins differ from one another by the nature of origin, composition, adsorption capacity, rate of endogenous detoxification, bioavailability, and from generation to generation due to technological developments they become more and more perfect and diverse in terms of adsorption properties, and also have an indirect therapeutic effect. Feed sorbents have the ability to quickly bind a wide range of toxicants. Sorbents are stable at different pH values, thermostable during feed granulation. The use of mycotoxin adsorbents as feed additives is beneficial to reduce the toxic effects of mycotoxins in pigs, which ensures more sustainable use of feed [8; 12; 20].

However, as noted by A. Kihal *et al.* [21], many feed additives with sorption properties bind vitamins, macro- and microelements. According to the findings of other authors, it was proved that the prolonged use of sorbents caused a decrease in the content of vitamins A, D and E and other elements in the blood of animals and poultry. Thus, T. C. Schell *et al.* [22]; K. E. Reddy *et al.* [23]; A. C. Weaver *et al.* [24] proved that aflatoxin B_1 had a detrimental effect on liver health and electrolytic balance in pigs, which led to a deterioration of functions and changes in the structure of the liver and kidney architecture. Productivity and resistance of pigs depends on providing them with sufficient nutrients and biologically active substances [21]. Thus, there is an important scientific and practical task to study the effect of different feed sorbents when used in diets with an average level of contamination with mycotoxins on the productivity of fattening pigs.

The purpose of the study is to identify the effect of a new complex sorbent of mycotoxins in the diets of store pigs on their growth performance, fattening, quantitative and qualitative meat traits in industrial technology.

Materials and Methods

Overall in the experiment, which lasted during 2021, 90 heads of fattening store pigs were used in the ratio: 50% – castrated boars and 50% – piglets, where the maternal form was a combination of breeds Large White × Landrace, and the paternal form was boars of the terminal line "Maxter", which were kept on the farm of LLC "Tavriyski svyni", Kherson region.

Fattening was divided into two periods: I period of fattening ("Grower") – animals with a live weight of 30-60 kg (12-17 weeks) consumed feed 2.4-2.6 kg per head per day using feed of the "Grower" type by nutritional value: crude protein – 180.25 g/kg; metabolisable energy – 13.04 MJ/kg, pigs were placed on a concrete slotted floor with an area of 0.65 m^2/head according to DNTD-IAC-02.05 "Pig enterprises (complexes, farms, small farms)" [25]; II period of fattening ("Finisher") – animals with a live weight of 61-120 kg (17-26 weeks) consumed 2.8-3.2 kg per head per day using a feed of the "Finisher" type with nutritional value: crude protein – 140.88-153.08 g/kg; metabolizable energy – 12.90-13.14 MJ/kg, pigs were placed on a concrete slotted floor with an area of 0.85 m^2/head according to DNTD-02.05 "Pig enterprises (complexes, farms, small farms)" [25]. As the basic diet (BD) was used a feed of domestic production with the use of premixes produced by the company "PC Alternative" (Ukraine) in the corresponding composition of "Grower" (%): wheat – 32; barley – 12.1; corn – 17.38; bran (wheat) – 8; soybean cake – 24.3; sunflower cake – 3.22; premix – 3; "Finisher" (%): wheat – 24; barley – 24; corn – 19; bran (wheat) – 12; soybean cake – 11.6; sunflower cake – 6.9; premix – 2.5.

When transferring pigs from the rearing unit to the fattening unit of the first period, to equalise the animals and the purity of the research in the period from 11-12 weeks, the equalisation period (EP) started. Further, all experimental animals were divided into three groups (according to the principle of analogues) based on generally accepted methods [26; 27], 30 animals in each group: I control group of pigs consumed the basic diet "Grower", "Finisher"; pigs of II experimental group consumed the basic diet "Grower",

"Finisher" with the addition of 0.15% by weight of feed of a commercial analogue of mycotoxin adsorbent; animals of III experimental group were fed the basic diet "Grower", "Finisher" with the addition of 0.15% by weight of feed of the complex preparation "Hepasorbex" (Table 1).

Table 1. *Scheme of using a feed additive in the experiment*

No.	Group	Feeding conditions
Age 11-12 weeks – equalisation period (EP)		
Age 12-17 weeks		
I	Control	"Grower"
II	Experimental	"Grower" + 0.15% by weight of feed "Commercial analogue"
III	Experimental	"Grower" + 0.15% by weight of feed "Gepasorbex"
Age 17-26 weeks		
I	Control	"Finisher"
II	Experimental	"Finisher" + 0.15% by weight of feed "Commercial analogue"
III	Experimental	"Finisher" + 0.15% by weight of feed "Gepasorbex"

The composition of 1 kg of feed additive "Gepasorbex" (LLC "Vetservisprodukt", Ukraine) contains the following active components (%): silicon dioxide – 60.2-70.8; aluminium oxide – 8-12; magnesium carbonate – 1.0-2.5; titanium dioxide – 0.8-0.15; selenium – 0.32-0.35; clinoptilolite – 4.2-4.5; active feed yeast – 8-10; milk thistle spotted – 18-20%.

Composition of the feed additive "Commercial analogue": silicon dioxide (SiO_2), kaolinite clay, magnesium silicate, inactivated yeast (*Saccharomyces Cerevisiae*), Sugar kelp, extracts of Wild Chicory and Calendula officinalis, dry matter – 954.0 g.

The main feed used for feeding pigs of experimental groups according to laboratory studies was recognized as slightly toxic for aflatoxin, ochratoxin and zearalenone, contract No. 837 of 07/06/2021 (Expert Centre "Biolights" LLC, Kyiv) [28].

At the age of 12-26 weeks, live weight (kg) and average daily gain (G) were determined. The following fattening traits of pigs were evaluated, in particular: age of reaching live weight (days), average daily gain (g), and feed conversion (kg) were determined in experimental groups of pigs when reaching a live weight of 100 and 120 kg, according to conventional methods [26; 27].

Slaughter qualities of experimental animals were studied according to the relevant methodological recommendations of the Institute of Pig Breeding and Agroindustrial Production of the National Academy of Agrarian Sciences of Ukraine [7; 27]. To assess the slaughter qualities, store pigs were selected for slaughter from groups of fattening pigs when they reached a live weight of 100 and 120 kg in the amount of 10 heads of each weight condition in the conditions of LLC "Tavriyski svyni". Control slaughter with subsequent determination of the slaughter qualities of experimental groups of animals was carried out by rolling carcasses according to generally accepted methods [27].

The effect of the complex additive "Hepasorbex" on the chemical properties of the longest back muscle of pigs of experimental groups was determined and analysed, for this purpose 10 samples of the longest back muscle (400 g) between 9-12 thoracic vertebrae were taken from the carcasses of slaughtered animals of each of the three groups using conventional methods [27; 29; 30]. To determine the chemical composition of the longest back muscle (*m. longissimus dorsi*) the obtained samples in the independent laboratory of LLC "Expert Centre "Biolights" were examined by a mass fraction, %: moisture, protein, fat, ash according to DSTU ISO 936:2008" meat and meat products. Method for determining the mass fraction of total ash" [31]. The performed methodology of scientific research is included in the accreditation for compliance with DSTU ISO/IEC 17025:2017 [28].

The rules for the treatment of animals in experiments are in accordance with European legislation on the protection and welfare of animals kept on farms (Directive 95/58 EC "On the Protection of Farm Animals" of the Council of the European Union of 07/20/1998 [32] as amended by Regulation (EC) No. 806/2003 of 14.04.2003 [33], No. 91/630 EC "Minimum Standards for the Protection of Pigs" of 11/19/1991 [34] as amended by Regulation (EC) No. 35.

Results and Discussion

A significant difference was found in the productive characteristics (live weight and average daily growth) of pigs of control and experimental groups at the age of 98 days, or at 14 weeks (Table 2).

Table 2. *Productive traits of experimental groups of pigs, (n = 30),* $\overline{X} \pm S_{\overline{X}}$

Trait	Group/Age		
	I – control	II – experimental	III – experimental
12 weeks			
Live weight, kg	35.50 ± 0.717	35.03 ± 0.812	35.83 ± 0.649

Table 2, Continued

Trait	Group/Age		
	I – control	II – experimental	III – experimental
14 weeks			
Live weight, kg	45.80 ± 0.637	46.23 ± 0.768	47.73 ± 0.629*
Average daily growth, g	735.7 ± 15.75	800.0 ± 19.19**	850.0 ± 12.04***a
17 weeks			
Live weight, kg	62.87 ± 0.610	64.20 ± 0.791	66.50 ± 0.645***a
Average daily growth, g	812.7 ± 15.64	855.6 ± 10.33*	893.7 ± 8.45***b
22 weeks			
Live weight, kg	93.33 ± 0.471	95.80 ± 0.720**	98.43 ± 0.544***b
Average daily growth, g	870.5 ± 11.92	902.86 ± 9.55*	912.40 ± 8.55**
26 weeks			
Live weight, kg	113.97 ± 0.367	118.13 ± 0.412***	120.97 ± 0.256***b
Average daily growth, g	736.9 ± 9.45	797.6 ± 15.35**	804.8 ± 13.23***

Notes: *(hereafter): * – R <0,05; ** – R <0,01; *** – R <0.001 (compared to animals of control group – group I); a – R <0,05; b – R <0.01 (compared to the animals of experimental group III with analogues of experimental group II)*

When starting fattening, all piglets had a live weight of 33-34 kg. For 14 weeks, pigs of experimental group III who consumed the complex preparation "Gepasorbex" significantly exceeded the live weight of animals of control group by 1.93 kg (p<0.05), and in terms of average daily growth, the advantage was observed in relation to animals as a control group by 114.3 g (p<0.001), and the experimental group II, which consumed a commercial analogue of mycotoxin adsorbent by 50 g (p<0,05).

At 17 weeks of age, the animals of experimental group III significantly prevailed in terms of live weight over the analogues of experimental group II by 2.3 kg (p<0.05) and the peers of control group I by 3.63 kg (p<0.001). The highest average daily increase was recorded in pigs that consumed the complex supplement "Gepasorbex" and significantly exceeded the studied indicator in pigs of control I and the experimental group I by 9.1% (p<0.001) and 5.9% (p<0.05), respectively.

In the period of 22 weeks of life of fattening store pigs, a significant advantage of animals of II and III experimental groups in terms of live weight and average daily weight gain by 2.47 kg (p<0.01), 32.36 g (p<0.05) and 5.1 kg (p<0.001), 41.9 g (r<0.01) respectively was established.

In the age period of 26 weeks, according to the live weight indicator, animals of experimental group III who consumed the complex feed additive "Gepasorbex" outnumbered the peers of both the II experimental and I control groups by 2.67 kg, respectively (p<0.01) and 7.00 kg (p<0,001). In terms of average daily weight gain, pigs of experimental groups II and III that consumed mycotoxin enterosorbents had higher values by 60.7 g (p<0.001) and 67.9 g (p<0.001), respectively, than the control group.

Thus, piglets from experimental groups II and III had a higher growth rate and significantly exceeded the control group analogues in live weight and average daily gain at all ages. Thus, pigs that received mycotoxin adsorbent in the main diet (experimental groups II, III) had higher growth rates.

However, the experimental studies conducted by a group of scientists [11] did not reveal a significant superiority in live weight and average daily weight gain between the control and experimental groups of pigs receiving the main diet with the addition of purified bentonite. However, according to the conclusive opinion of M.D. Subramaniam, I.H. Kim [36], higher growth rates in pigs are explained by an increase in the absorption of certain nutrients in the case of using clay as an adsorbent of mycotoxins by an experimental group of animals, which is consistent with this study. J.H. Li, I.H. Kim [37] reported that growing pigs fed a basic diet with the addition of 0.5% sericite had 6.6% higher live weight gain and 5.1% better feed conversion rate compared to pigs fed a diet without additives. According to D.S. Alexopoulos *et al.* [38], a higher increase of 5.3% was observed in pigs from 25 to 110 kg, which were provided with clay supplementation in the main diet. These results are also consistent with the current study.

It was found that animals fed complex supplements with enterosorbents of mycotoxins: experimental groups II and III, respectively, reached a live weight of 100 kg 3.0 (p<0.01) and 6.0 (p<0.001) days earlier compared to the peers of control group I (Table 3).

Table 3. *Fattening traits of store pigs, (n = 30),* $\overline{X} \pm S_{\overline{X}}$

Group	Age of reaching a live weight of 100 kg, days	Average daily gain during fattening, g	Feed conversion, kg
live weight of 100 kg			
I – control	161.7 ± 0.56	826.6 ± 7.66	3.39
II – experimental	158.7 ± 0.80	868.1 ± 5.96	2.94
III – experimental	155.7 ± 0.58	894.3 ± 5.88	2.85
+/- II to I	-3.0**	+41.5***	-0.45

Table 3, Continued

Group	Age of reaching a live weight of 100 kg, days	Average daily gain during fattening, g	Feed conversion, kg
+/- III to I	-6.0***	+67.7***	-0.54
live weight of 120 kg			
I - control	190.2 ± 0.49	800.7 ± 5.46	3.50
II - experimental	184.2 ± 0.48	848.0 ± 6.21	3.30
III - experimental	180.7 ± 0.32	868.7 ± 5.26	3.22
+/- II to I	-6.0***	+47.3***	-0.20
+/- III to I	-9.5***	+68.0***	-0.28

The values of average daily gains in pigs of experimental groups II and III, which used a commercial analogue of the adsorbent of mycotoxins and, in fact, the feed additive "Hepasorbex" were significantly higher (p<0.001) by 41.5 g and 67.7 g, respectively; for feed conversion for the experimental group II the index reached 2.94 kg, and for the experimental group III – 2.85 kg, than the same index of animals of control group I, where the feed conversion was 3.39 kg.

The study of fattening indices at reaching 120 kg of live weight by experimental animals showed a significant excess (p<0.001) in animals of experimental groups II and III in terms of average daily weight gain and amounted to 47.3 g and 68.0 g relative to store pigs that did not use mycotoxin enterosorbent supplements in the main diet.

Similarly, the animals of experimental groups II and III reached the expected live weight (120 kg) 6.0 and 9.5 days earlier than the peers of the control group. At the same time, they have significantly higher average daily gains compared to the control group by 47.3 g (p<0.001) and 68.0 g (p<0.001), respectively. The lowest rate of feed conversion was recorded in the pigs of experimental group III – 3.22 kg, which is 0.28 kg less than the same value in the pigs of control group I – 3.50 kg.

The conducted experiments [39; 40] also confirmed the positive effect of the use of sorbents in the diet of fattening pigs, which, in turn, improved the average daily gain, feed utilisation and feed conversion rate in crossbred animals (Duroc × Landrace × Yorkshire).

Based on the evaluation of the slaughter qualities of experimental groups of pigs (Table 4), it was found that the pigs of experimental group III dominated the slaughter yield over the peers of the I control group by 4.1% (p<0.001) at slaughter with a live weight of 100 kg and 0.5% – 120 kg. By the length of the half-carcass at the slaughter at 100 kg of weight, store pigs of experimental groups II and III showed a maximum length – 96.7 cm, which is 2.1 cm more than the same indicator of animals of control group I (p<0.05).

Table 4. *Slaughter qualities of young pigs, (n = 10),* $\overline{X} \pm S_{\overline{X}}$

Group	Slaughter yield, %	Half-carcass length, cm	Lard thickness, mm	Loin-eye area, cm²	Weight of the back third of the half-carcass, kg
Pre-slaughter live weight of 100 kg					
I – control	71.1 ± 0.76	94.6 ± 0.58	18.2 ± 0.89	36.8 ± 0.34	10.9 ± 0.32
II – experimental	75.0 ± 0.62	96.7 ± 0.69	15.2 ± 0.51	39.2 ± 0.29	11.4 ± 0.17
III – experimental	75.2 ± 0.58	96.7 ± 0.62	14.0 ± 0.54	39.8 ± 0.28	11.6 ± 0.21
+/- II to I	+3.9***	+2.1*	-3.0**	+2.4***	+0.5
+/- III to I	+4.1***	+2.1*	-4.2***	+3.0***	+0.7
Pre-slaughter live weight of 120 kg					
I – control	75.8 ± 0.52	102.6 ± 1.07	26.2 ± 0.74	42.9 ± 1.02	14.3 ± 0.14
II – experimental	76.2 ± 0.58	103.1 ± 1.25	19.1 ± 0.62	43.4 ± 0.98	14.7 ± 0.16
III – experimental	76.3 ± 0.56	103.6 ± 1.49	18.0 ± 0.55	44.1 ± 1.03	14.8 ± 0.17
+/- II to I	+0.4	+0.5	-7.1***	+0.5	+0.4
+/- III to I	+0.5	+1.0	-8.2***	+1.2	+0.5*

It was found that at a pre-slaughter live weight of 120 kg the animals of experimental group III prevailed over the animal in the control group by 1.0 cm, but the difference is statistically insignificant.

The animals of group III both at slaughter with a live weight of 100 kg and 120 kg had a thinner carcass by 4.2 cm and 8.2 mm, respectively, compared to the animals of control group I (p< 0.001).

The dynamics of changes in muscle and adipose tissue is manifested by different size of the "lion eye" area, which positively correlates with the yield of meat in pig carcasses and is the main criterion for assessing their meat content [16; 17]. It was found that the area of the loin eye in experimental groups ranged from 36.8-39.8 cm² when pigs reach a live weight of 100 kg and 42.9-44.1 cm² – 120 kg, respectively. The animals of experimental group III exceeded the store pigs of control group I in terms of the lion eye area by 3.0 cm² (for pre-slaughter live weight of 100 kg), at p<0.001 and 1.2 cm² (for pre-slaughter live weight of 120 kg).

In terms of the weight of half-carcass hind third, there was an increase in the weight of hock in animals of experimental groups II and III, which during the fattening period were fed with adsorbents of mycotoxins both "hepasorbex" and commercial analogue, but no significant differences between groups of animals were found. Thus, the use of mycotoxin adsorbent "gepasorbex" in the diet of store pigs of experimental group III contributed to the improvement of slaughter qualities both with a live weight of 100 kg and 120 kg.

Currently, the pig breeding industry shows a tendency towards increasing meat content while improving the quality of pork. However, most animals with a high yield of meat have an increased moisture content in it and, as a result, flabbiness is recorded and the intensity of the colour of meat raw materials decreases, which causes unprofitability of the entire meat processing industry of the country [16].

The evaluation of slaughter products revealed that the chemical properties of meat depend on the assigned purpose of the group in the experiment. The mass fraction of moisture in the meat of animals of all experimental groups was in the range of 63.75-68.25% at a pre-slaughter weight of 100 kg and 63.21-67.70% – slaughtered at 120 kg (Table 5).

The value of the mass fraction of moisture was within the physiological norm, but there was a significant difference between the groups on this indicator. It should be noted that at a pre-slaughter weight of 100 and 120 kg, animals of both experimental groups II and III had a significantly lower moisture content in meat – 65.43% and 63.75%, 65.12% and 63.21%, respectively, than store pigs of control group I – 68.25% slaughtered at 100 kg and 67.70% – 120 kg, where the differences are statistically significant (p<0.001).

Table 5. *Chemical composition of the longest back muscle of pigs (m. longissimus dorsi), (n = 10),* $\overline{X} \pm S_{\overline{X}}$

Group	Mass fraction, %			
	Moisture content	Protein	Fat	Ash
Pre-slaughter live weight of 100 kg				
I – control	68.25 ± 0.389	19.08 ± 0.331	11.65 ± 0.473	1.02 ± 0.029
II – experimental	65.43 ± 0.291	19.36 ± 0.326	14.09 ± 0.494	1.12 ± 0.037
III – experimental	63.75 ± 0.382	21.92 ± 0.390	13.05 ± 0.362	1.28 ± 0.022
+/- II to I	-2.82***	+0.28	+2.44***	+0.10*
+/- III to I	-4.50***	+2.84***	+1.40*	+0.26***
Pre-slaughter live weight of 120 kg				
I – control	67.70 ± 0.504	18.90 ± 0.327	12.22 ± 0.272	1.18 ± 0.033
II – experimental	65.12 ± 0.419	19.00 ± 0.368	14.72 ± 0.312	1.16 ± 0.029
III – experimental	63.21 ± 0.480	21.75 ± 0.340	13.65 ± 0.278	1.39 ± 0.027
+/- II to I	-2.58***	+0.10	+2.5***	-0.02
+/- III to I	-4.49***	+2.85***	+1.43***	+0.21***

The presence of adipose tissue in meat is known to increase its caloric content, contribute to its tenderness and flavour, and, in contrast, excessive fat decreases the protein content, as the nutritional value decreases [16; 29; 30].

In terms of the chemical composition of the muscle tissue – at a pre-slaughter live weight of 100 kg, the highest fat content in meat was found in pigs of experimental group II at the level of 14.09%, which significantly exceeded the value of the identical indicator of control group I by 2.44% (p<0.001). At a pre-slaughter live weight of 120 kg, pigs of experimental group II also had the highest mass fraction of fat – 14.72%, which significantly exceeded those of control group I by 2.5% (p<0.001). As for the mass fraction of fat in meat, the animals of experimental group III, which consumed the complex additive of mycotoxin adsorbent "Hepasorbex", have intermediate position and the value of this indicator at a pre-slaughter live weight of 100 kg, and 120 kg at the level of 13.05% and 13.65%, which evidences the obvious caloric content and tenderness of meat raw materials obtained from animals of this group while maintaining the mass fraction of protein, which affects the nutritional value of meat.

An essential component of meat is proteins, consisting of essential and nonessential amino acids [29]. Thus, in slaughtered animals with a live weight of 100 kg, the store pigs of experimental group III had the greater content of the mass fraction of protein – 21.92% ± 0.390, which (p<0.001) exceeded the same indicator of animals in the control group I. Similarly, the likely prevalence of pigs of experimental group III by the value of this indicator was established in slaughtered store pigs with a live weight of 120 kg – by 2.85% (p<0.001) compared to control animals.

The mass fraction of ash in the meat of pigs of the experimental groups ranged from 1.02% to 1.28% slaughtered at 100 kg of weight and from 1.16% to 1.39% – at 120 kg. A significant difference was found between animals at a pre-slaughter weight of 100 kg: 0.10% (p<0.05) – experimental group II, 0.26% (p<0.001) – experimental group III. At a pre-slaughter weight of 120 kg, a significant difference was observed only in animals of experimental group III – 0.21% (p<0.001), while pigs of experimental group II were by 0.02% inferior to control analogues, although the difference was not statistically significant. Thus, given the increased moisture content and a lower percentage of dry matter in

meat obtained from pigs of control group I slaughtered at 100 kg of weight, a lower ash content of 1.02% ± 0.029 was detected. The lowest ash content – 1.16% ± 0.029 is found in animals of experimental group II slaughtered at 120 kg.

A similar study on the effect of sorbents on the slaughter performance of pig carcasses was conducted by M. Ossowski, Ł. Wlazło, B. Nowakowicz-Dębek, M. Florek, in their manuscript "Effect of natural sorbents in the diet of fattening pigs on meat quality and suitability for processing" [41] investigated and evaluated the effect of sorbents, mainly on the physicochemical properties of pork. Results showed that the addition of 0.5% zeolite to the feed for crossbred pigs (Landrace × Yorkshire × Duroc) had no significant effect on the approximate chemical composition of the long muscle (loin), but lower moisture (70.23%) and ash (1.16%), but higher protein (26.06%) and fat (2.55%) were recorded, which is consistent with the studies conducted.

Conclusions

Based on the results of the experiment, it was determined that animals that received a complex additive of mycotoxin adsorbent "Gepasorbex" LLC "Vetservisproduct" had higher performance.

1. Pigs of experimental groups II and III, which consumed feed containing adsorbents of mycotoxins had a significant (p<0.001) increase in live body weight by 2.3-4.2 kg and 3.6-7.0 kg; average daily gains – 41.5-47.3 g, 67.7-68.0 g; reached weight standards of 100 kg (by 3 and 6 days) and 120 kg (by 6 and 9.5 days) earlier with a lower feed conversion by 0.2-0.45 and 0.28-0.54 kg, respectively, compared to animals of the control group.

2. When using mycotoxin adsorbent "Gepasorbex" in the diet of store pigs of experimental group III with a pre-slaughter weight of 100 and 120 kg increased: the slaughter yield – by 0.5-4.1% (p<0.001); the length of the half carcass – by 1.0-2.1 cm (p<0.05); lion eye area – by 1.2-3.0 cm^2 (p<0.001); the weight of the hind third of the half carcass – by 0.5-0.7 kg (p<0.05) and the lard thickness index decreased by 4.2-8.2 mm (p<0.001), respectively, compared to pigs of control group I.

3. The chemical composition of the meat of the animals of the experimental groups, both when slaughtered at 100 kg and 120 kg, met the requirements for pork of normal quality (NORMAL). At a live weight of 100 and 120 kg, pigs of experimental group III with the use of "Hepasorbex" in meat had significantly (p<0.001), %: lower moisture content by 4.49-450; higher protein content – by 2.84-2.85, fat – by 1.40-143, ash – by 0.2-0.26.

The obtained results determine the prospects for further research in continuing to study the effect of feed sorbents on the productive traits of other technological groups of pigs.

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Вплив нового комплексного сорбенту мікотоксинів у раціонах свиней на їхні показники росту, відгодівельні та м'ясні ознаки

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Анотація. Дотримання безпеки кормів у тваринництві вимагає від виробників свинини додавання до раціонів свиней адсорбенти, що зв'язують мікотоксини. З цієї причини, мета дослідження полягала в оцінці дії двох комплексних сорбентів, що додані до раціону відгодівельних свиней на їх продуктивність. В експерименті використано 90 голів свиней, які утримувались у ТОВ «Таврійські свині» Херсонської області. Дослідні тварини, за принципом аналогів поділені на три групи по 30 голів у кожній: І контрольна група свиней використовували основний раціон «Гроуер», «Фінішер»; свині ІІ дослідної групи споживали основний раціон «Гроуер», «Фінішер» з додаванням 0,15 % за масою корму комерційного аналогу адсорбенту мікотоксинів; тваринам ІІІ дослідної групи застосовували основний раціон «Гроуер», «Фінішер» з додаванням 0,15 % за масою корму комплексного препарату «Гепасорбекс». Тварини, які споживали комбікорм, що містив адсорбенти мікотоксинів мали більшу живу масу тіла, середньодобові прирости, раніше досягали вагових кондицій 100 і 120 кг із нижчою конверсією корму, порівняно з аналогами контрольної групи. Встановлено, що за використання «Гепасорбекс» у раціоні молодняку свиней ІІІ дослідної групи за передзабійної маси 100 і 120 кг збільшилися: забійний вихід, довжина напівтуші, площа «м'язового вічка», маса задньої третини напівтуші та знизився показник товщини шпику, порівняно з аналогами контрольної групи. За хімічним складом м'ясо тварин піддослідних груп як при забої у 100 кг, так і у 120 кг, відповідало вимогам щодо свинини нормальної якості (NORMAL). За живої маси 100 і 120 кг свині ІІІ дослідної групи у м'ясі мали вірогідно нижчий вміст вологи, більший вміст білка, жиру і золи. За рахунок комплексного складу компонентів «Гепасорбекс» поживні речовини у складі комбікорму залишалися і засвоювалися організмом свиней, що підтверджується вищими показниками продуктивності та суттєво здешевлює основну витратну статтю господарств із технологій виробництва продукції свинарства – «Корми». Тому, корисними дані дослідження є для фахівців з виробництва і переробки свинини у розробці стратегій годівлі свиней та отримання якісної сировини для переробних підприємств, що відкриває шляхи для забезпечення продовольчої безпеки країни

Ключові слова: вагова кондиція, годівля, кормові сорбенти, продуктивність, свинарство